Has the California Drought Returned?

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In 1993, enough rain and snow fell to end the 1987-1992 drought in California, at least in most areas. The 1994 season has again been dry and has given rise to questions about whether the drought has returned. But carryover reservoir storage from 1993 has been good and will be meeting a portion of the state's water needs this year. Concern about 1995 has placed California in a "drought watch" mode for 1994, a stage indicating caution but not yet a full drought.

Comparison with Past Years

As of April 1, 1994, some comparisons of water supply parameters (in percent of average unless noted otherwise) are:

	1994	1993	1992
Statewide precipitation	60	150	90
Snowpack water content	50	150	60
Statewide runoff to date	40	110	45
Reservoir storage	95	90	70
Forecasted water year runoff	45	125	50
Northern Sierra precipitation, inches	26.0	54.4	30.0
Forecasted Sacramento River Index, MAF	8.5	21.4	9.5

Water year 1992 was at the end of the previous 6-year drought. Even then, statewide precipitation figures were boosted by the wetter-than-average 1992 in southern California; a more typical drought level was 75 percent. The 1993 reservoir storage level does not yet contain the excellent snowmelt runoff, which would eventually raise overall summer storage levels to about 110 percent of average.

Drought Thresholds

There is no standard definition of drought, and there probably should not be one; to some extent drought is related to the impact on water users. Most agriculture in California depends on irrigation to raise crops during the long, hot dry season when natural streamflow is inadequate. Except for some dry-farmed winter grain and natural pasture, hydrological drought is the concern instead of meteorological drought (although the two terms are related). Water storage has long been part of the water environment and tends to insulate us from a single year of drought. Because the water supply system is partially an artificial environment, it seems reasonable that two parameters would be involved in a determination of drought: (1) natural runoff and (2) water in storage.

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Drought should be based on relatively rare natural conditions. A reasonable threshold is that water year runoff (or predicted runoff) for a single year or a multiple set of years should be in the lower 10 percent of the historical range. The year 1994 would meet that criteria, although barely so, with the April 1 forecasts. The second part of a drought definition is reservoir storage. This should be less than 70 percent of average, I think.

There is nothing magic about 70 percent. If one wished to be more conservative, an argument could be made for 75 percent (and also for runoff to be in the lowest 15 percent). However, two dry years were required to reduce storage below 70 percent in 1988 (eventually to 14.8 million acre-feet and 68 percent of the current average 21.7 MAF for the 155 major in-state reservoirs on September 30 of that year) (Figure 1).

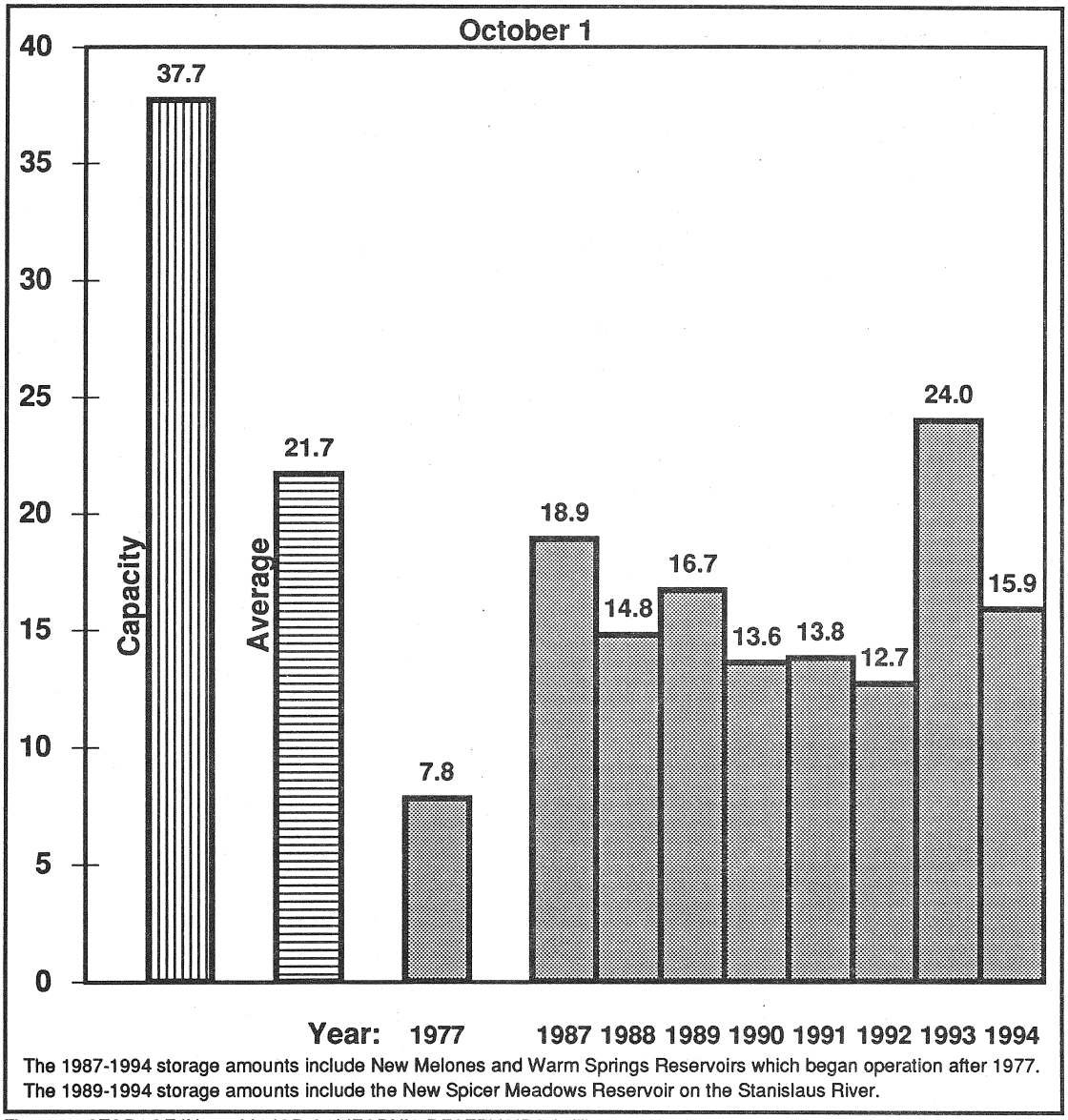

Figure 1. STORAGE IN 155 MAJOR CALIFORNIA RESERVOIRS (million acre-feet)

End of September storage in 1987 was 18.9 MAF, 87 percent of average and down about 9 MAF from April 1 storage. Storage in 1976 did drop below 70 percent — to 13.9 MAF or 64 percent — in one severe year.

April 1 reservoir storage now in 1994 stands at 24.2 MAF, 93 percent of average for the date, hardly alarming. Projected end of water year storage in 1994 is about 16 MAF, which would be 74 percent of average. This would leave water year ending storage just above the 70 percent threshold — not quite qualifying for drought status. Carryover storage from 1993 will soften the impact of low runoff this year, but concern about a possible second dry winter has placed California in an official "drought watch". The longer-term outlook for 1995 is precarious, dependent on increased precipitation next winter.

Water deliveries for State Water Project and Central Valley Project service areas are being curtailed in 1994, primarily because of the dryness of the year, but partly due to restrictions on winter and spring export from the Sacramento-San Joaquin Delta as a result of endangered species requirements. The State Water Project will deliver 50 percent of contractor amounts and the U.S. Bureau of Reclamation is delivering only 35 percent of Central Valley Project agricultural supplies (except that water rights and exchange agreement users get 75 percent) and 75 percent of urban supplies. Wildlife refugees will get 75 percent.

Addendum

Conditions remained drier than normal after April 1, 1994. The Sacramento River (Four River) Index turned out to be 7.8 MAF, the fourth driest of record and 42 percent of the 18.4 MAF average. Southern Sierra runoff into the San Joaquin and Tulare Lake basins was not quite as dry, ranking around the tenth driest of record, but was still less than half of average. Storage in the 155 major reservoirs on September 30, 1994, was 15.9 MAF, about 73 percent of average for the date. Figure 2 shows Sacramento River Index runoff for the current and recent years.

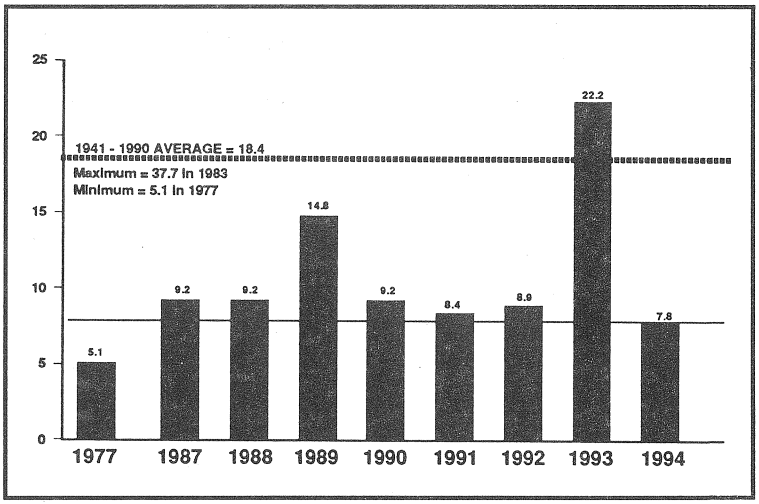

Figure 2. SACRAMENTO RIVER INDEX (million acre-feet).
The Sacramento River Index is the sum of unimpaired runoff from the Sacramento River at Bend Bridge, Feather River inflow to Lake Oroville, Yuba River at Smartville, and American River inflow to Folsom Lake.
The water year is October 1 through September 30.